1985

Performance and slaughter characteristics of 1- and 2-year-old Hereford and Hereford-Brahman steers grazing Pensacola bahiagrass, Coastal bermudagrass, and Dallisgrass

T W. White

Performance and Slaughter Characteristics of 1- and 2-Year-Old Hereford and Hereford-Brahman Steers Grazing Pensacola Bahiagrass, Coastal Bermudagrass, and Dallisgrass

T. W. WHITE and F. G. HEMBRY

Bulletin No. 768

June 1985

LOUISIANA AGRICULTURAL EXPERIMENT STATION
LOUISIANA STATE UNIVERSITY AGRICULTURAL CENTER

Contents

Acknowledgments

The authors express appreciation to the following personnel of the Louisiana Agricultural Experiment Station: Mr. Hershel Morris and the staff of the Feed and Fertilizer Laboratory for sample analysis; Mr. Billy Nelson, Southeast Research Station, for sample analysis and manuscript review; Dr. Arnold Saxon, Department of Experimental Statistics, for statistical analysis and manuscript review; Dr. Richard Taylor and Mr. John Knox, Rice Research Station, for manuscript review; and Mr. C. C. Willis, Rice Research Station, for help in caring for the steers and collecting forage samples.

Louisiana Agricultural Experiment Station, Doyle Chambers, Director
Louisiana State University Agricultural Center, H. Rouse Caffey, Chancellor

Performance and Slaughter Characteristics of 1- and 2-Year-Old Hereford and Hereford-Brahman Steers Grazing Pensacola Bahiagrass, Coastal Bermudagrass, and Dallisgrass

T. W. WHITE[1] AND F. G. HEMBRY[2]

Beef production in southwest Louisiana has declined in the past several years. However, the remaining beef cattle are generally better quality and are managed better than 20 years ago. Even with increased row crop cultivation, land remains that is better suited for grazing. Further, a market exists for the beef cattle produced in this area.

Common bermudagrass is the predominate pasture grass in southwest Louisiana, although there is some Coastal bermudagrass, bahiagrass, and dallisgrass. Coastal bermudagrass has become the principal forage grass in Louisiana. Bahiagrass and dallisgrass enjoy much less recognition but may be more important as forages in this area than is usually recognized.

As feed grain costs have increased emphasis has changed from the feedlot to pasture beef production. Knox et al. (1982) reported that Hereford-Brahman calves were heavier than Hereford calves and that the actual differences in weight between these breed groups increased with age. It is also recognized that older cattle will fatten faster than younger cattle. This experiment was conducted to compare 1- and 2-year-old Hereford and Hereford-Brahman reciprocal crossbred steers grazing Coastal bermudagrass, Pensacola bahiagrass, and common dallisgrass.

Experimental Procedure

Coastal bermudagrass (*Cynodon dactylon* (L.) Pers.), Pensacola bahiagrass (*Paspalum notatum* Var. saurae Parodi), and common dallisgrass (*Paspalum dilatatum* Poir.) pastures were established about 10 years prior

[1]Professor, Rice Research Station, Box 1429, Crowley, La. 70527-1429.

[2]Professor, Department of Animal Science, Agricultural Experiment Station, LSU Agricultural Center, Baton Rouge, La. 70803.

to initiating this experiment. The pastures, located at the beef facility of the Rice Research Station, had been limed previously according to soil tests and were fertilized with 200-100-100 pounds per acre (N-P_2O_5-K_2O) annually. Phosphorus and potassium were applied in the spring and the nitrogen applied in four equal increments during the grazing season. Simazine and 2-4-D were applied in the spring to control annual grasses and broadleaf weeds. The grazing season started in late April and was terminated after 140 days.

During the last 2 years, forage samples were taken on the day grazing was initiated and at 14-day intervals thereafter. This was accomplished by throwing a metal ring at random six times throughout the 6.6 acre pasture and cutting the forage inside the 235 square inch ring to a height of .5 inch. Fresh forage samples were weighed and dried in a forced air oven at 50°C, ground through a 1-mm screen, and stored in air-tight containers.

Crude protein was determined by the Kjeldahl method, and moisture, ash, and crude fiber by the procedures described by A.O.A.C. (1970). Acid detergent fiber and neutral detergent fiber were determined by the method of Goering and Van Soest (1970). In vitro dry matter disappearance was determined by the Goering and Van Soest (1970) 2-stage rumen fermentation procedure as modified by Nelson et al. (1972), and dry matter digestibility estimated by the regression equation of Nelson et al. (1976).

During the first 2 years of the experiment, two 1-year-old and two 2-year-old Hereford steers and two 1-year-old and two 2-year-old Hereford-Brahman reciprocal crossbred steers were assigned to a 3.3 acre pasture of each of the three forage grasses. During the last 2 years, the size of the pastures was increased to 6.6 acres, and the number of steers increased to six 1-year-old and three 2-year-old steers of each breed on each forage. Therefore, eight steers grazed each forage during the first 2 years, and 18 steers grazed each forage during the last 2 years of this experiment. The average initial weight of the 1-year-old Hereford, 2-year-old Hereford, 1-year-old Hereford-Brahman, and 2-year-old Hereford-Brahman steers was 496, 653, 502, and 769 pounds, respectively.

Steer weights were taken initially and at 28-day intervals after a 15-hour shrink. All of the 2-year-old steers and half of the 1-year-old steers were slaughtered and carcass data obtained at the end of the grazing season each year. The remaining 1-year-old steers were kept until the following year and grazed as 2-year-old steers. Carcasses were graded according to U.S.D.A. standards and measurements made according to Schoonover (1965). The data were subjected to analysis of variance and significance of differences among treatment means was determined by the multiple range test (Duncan, 1955).

Results and Discussion

The performance of 1- and 2-year-old Hereford and Hereford-Brahman steers grazing Pensacola bahiagrass, Coastal bermudagrass, and common dallisgrass is shown in Table 1. The Hereford-Brahman cross steers gained faster and had heavier carcasses ($P<.05$) than Hereford steers. This is in agreement with a report by Reynolds et al. (1967) that Brahman-Angus heifers gained more than Angus heifers grazing summer grass. Knox et al. (1982) also found that Hereford-Brahman steers were heavier than Hereford steers. Oliver (1974) reported that crossbred steers of several breeds gained more than Hereford steers on winter pasture. In contrast, Feazel et al. (1972) showed no difference in the performance of Angus and Brahman-Angus cattle grazing winter pasture.

Hereford-Brahman steers had larger ribeyes ($P<.05$) than Hereford steers, but this was because of the heavier carcasses and was not the case when ribeye area was expressed per 100 pounds of carcass. Even though there was more ($P<.05$) fat over the twelfth rib of the Hereford-Brahman steers than the Hereford steers, the marbling scores and carcass grades were not improved. Carcasses which had traces minus of marbling graded standard and were definitely not desired by beef packers.

Table 1.—Performance of steers grazing three summer forage grasses

Item	Avg. daily gain, lb	Carcass wt., lb	Dress (%)	Carcass grade[1]	Marbling[2]	Ribeye area (sq in)	Fat thickness (mm)
Breeding							
Hereford	.62d[3]	359.1d	52.7d	7.3	4.0	8.8d	2.6d
Hereford X Brahman	.99c	436.5c	54.1c	7.2	3.7	9.5c	3.4c
Age							
1 year	.75d	323.4d	51.8d	6.6d	2.4d	8.4d	1.3d
2 years	.90c	472.2c	55.1c	7.9c	5.3c	10.0c	4.5c
Grass[4]							
Bahiagrass	.72d	389.2	53.3	7.0d	3.4d	9.1	2.6
Coastal bermudagrass	.81cd	394.9	53.3	7.2cd	3.7d	9.2	3.0
Dallisgrass	.90c	409.4	53.7	7.5c	4.4c	9.4	3.1
Year[4]							
1	.39e	427.9c	54.8c	7.9c	5.1c	9.3	3.5d
2	.97c	414.9cd	53.3d	7.8c	3.5d	8.9	5.2c
3	.98c	395.5d	52.7d	6.8d	3.9d	9.4	2.4e
4	.76d	368.7e	53.4d	6.8d	3.3d	9.1	1.5f

[1]Low standard = 6, standard = 7, high standard = 8.

[2]Practically devoid = 2, practically devoid plus = 3, traces minus = 4, traces = 5.

[3]Means in the same group and column with different letters are different ($P<.05$).

[4]There was a significant ($P<.05$) interaction between grass and year for average daily gain, carcass grade, and marbling score. Therefore, these data are presented by grass and year in Table 2.

The 2-year-old steers gained faster and had heavier carcasses which were superior in all measured traits to the 1-year-old steers ($P<.05$). Duncan (1958) summarized a 3-year study showing that yearling steers gained more than 2-year-old steers on summer pasture. However, the 2-year-old steers had gained more during the previous wintering period and weighed 850 to 900 pounds when grazing was initiated. Oliver (1972) reported that yearling steers gained faster than weanling steers. It is generally accepted that older cattle will gain faster than younger cattle. Because older cattle are approaching their mature weight, they will also fatten faster.

The 2-year-old steers had more fat over the twelfth rib and more marbling, and they graded higher ($P<.05$) than the 1-year-old steers. There were only traces of marbling in the 2-year-old steers, which increased the carcass grade to high standard which was well below the high good to low choice carcass grades desired by most packers. This agrees with data reported by McClaugherty and Carter (1961) wherein carcasses from steers grazing summer pasture with no supplement graded high standard. Hoveland et al. (1971) stated that yearling cattle grazing Coastal bermudagrass have not been satisfactory for slaughter because the carcasses usually grade utility at the end of the grazing season.

Average daily gains and carcass grades were higher ($P<.05$) for steers grazing dallisgrass than Pensacola bahiagrass but not significantly different from steers grazing Coastal bermudagrass. Hill et al. (1981) reported that cows performed similarly on Alicia bermudagrass and dallisgrass pastures, but calf performance was slightly higher on the latter. Average daily gain of .81 pound by steers grazing Coastal bermudagrass is similar to the gain reported by Oliver (1972) for weanling steers but less than yearling steers (Oliver, 1972; Suman and Woods, 1966; and Wise et al., 1967). Hoveland et al. (1971) reported average daily gains ranging from .75 to 1.25 pounds depending on location. These workers found that average daily gain and gain per acre were higher for Coastal bermudagrass than Pensacola bahiagrass.

Hill and Woods (1966) reported that average daily gains were slightly higher for calves grazing Pensacola bahiagrass and common bermudagrass than for those on Coastal bermudagrass, while gain per acre was higher ($P<.05$) for the latter grass. Chapman et al. (1972) reported that the average daily gain of steers grazing Pensacola bahiagrass was higher ($P<.05$) than that of steers grazing Coastal bermudagrass when stocked at two and two and a half steers per acre but similar when stocked at three steers per acre. Utley et al. (1974) found that steers grazing Pensacola bahiagrass gained similarly to those grazing Coastal bermudagrass in one experiment and less ($P<.05$) in another experiment. Gains reported by these Georgia workers are slightly higher than reported herein for Pensacola bahiagrass and Coastal bermudagrass.

Average daily gains were lowest ($P<.05$) in the first year and highest in the second and third years. This simply indicates the yearly variation that can be expected in the performance of beef cattle grazing summer pasture. Carcass characteristics did not follow the same trend as gains. Carcass grades were one-third grade higher ($P<.05$) in years 1 and 2 than in years 3 and 4. There was more marbling ($P<.05$) in steers slaughtered in year 1 and more external fat ($P<.05$) on steers slaughtered in year 2. These differences may be related to the previous year's gain of 2-year-old steers or gains during wintering. There was a significant ($P<.05$) interaction between grass and year for average daily gain, carcass grade, and marbling score. Therefore, these data are presented by grass and year in Table 2.

Forage samples of each grass were taken at 14-day intervals during the last 2 years of this experiment. The percentage and weight of dry matter in the samples and the percentage of crude protein, crude fiber, ash, neutral detergent fiber, acid detergent fiber in the dry matter, and estimated dry matter digestibility are shown in Table 3. There were no significant differences in composition of the dry matter or estimated dry matter digestibility among the grasses. However, there was more ($P<.01$) dry matter in the Pensacola bahiagrass and Coastal bermudagrass samples than in the dallisgrass samples. This did not appear to be a limiting factor because steers gained more on the dallisgrass than on Pensacola bahiagrass. The smaller amount of dry dallisgrass does not suggest younger and more nutritious forage since analysis revealed no differences among the grasses.

Table 2.—Average daily gain, carcass grades, and marbling scores by year and grass

Grass	Year			
	1	2	3	4
		Average daily gain, lb.		
Bahiagrass	.33	.71	1.01	.62
Coastal bermudagrass	.33	.98	1.03	.77
Dallisgrass	.51	1.23	.92	90
		Carcass grade[1]		
Bahiagrass	8.6	6.8	6.3	6.8
Coastal bermudagrass	7.1	7.9	7.2	6.8
Dallisgrass	8.0	8.9	6.8	7.0
		Marbling score[2]		
Bahiagrass	5.9	2.1	2.9	3.1
Coastal bermudagrass	4.0	3.2	4.4	3.2
Dallisgrass	5.4	5.0	4.2	3.7

[1]Low standard = 6, standard = 7, high standard = 8.

[2]Practically devoid = 2, practically devoid plus = 3, traces minus = 4, traces = 5, traces plus = 6.

Table 3.—Percentage and quantity of dry matter in samples of three grasses and the composition of the dry matter at each sampling date

Sampling date	Sample dry matter		Percent of dry matter					
	Percent	Grams	Crude protein	Ash	Crude fiber	Acid detergent fiber	Neutral detergent fiber	Estimated dry matter digestibility
					Pensacola bahiagrass			
4-18	35.7	261.5	16.4	18.8	23.0	39.2	68.0	54.8
5-2	32.0	233.2	15.0	10.4	26.8	34.0	68.2	58.2
5-16	31.0	237.8	14.8	15.2	24.9	36.5	67.8	56.9
5-30	32.6	358.0	11.3	9.7	28.5	35.0	68.6	56.8
6-13	30.2	283.0	10.9	8.6	29.8	35.9	68.8	55.9
6-27	36.1	470.0	11.0	8.0	29.4	36.4	68.3	55.7
7-11	33.2	344.0	10.5	9.0	28.9	38.5	72.0	54.0
7-25	31.1	480.0	9.2	9.0	30.6	38.1	71.9	52.4
8-8	30.2	485.0	10.4	8.1	29.2	37.7	71.8	54.4
8-22	31.6	611.3	10.7	8.8	29.8	40.2	70.4	53.0
Mean	32.4	376.3a[1]	12.1	10.4	28.1	37.2	69.6	55.2
					Coastal bermudagrass			
4-18	29.7	264.4	16.5	16.4	25.7	38.7	67.6	53.9
5-2	29.2	292.2	13.9	9.2	29.6	35.4	68.5	58.0
5-16	27.5	200.0	15.2	12.0	27.0	35.8	67.8	57.0
5-30	31.7	328.5	14.6	8.8	28.7	33.8	68.6	57.9
6-13	30.0	316.0	12.6	10.1	28.8	36.5	70.2	54.0
6-27	38.4	465.6	12.4	8.8	30.2	37.4	71.0	56.3
7-11	31.4	314.6	14.2	10.4	29.5	38.6	70.6	54.2
7-25	30.0	459.8	12.4	8.6	31.8	39.0	72.5	53.1
8-8	32.9	565.9	10.0	8.4	31.4	38.6	72.5	52.6
8-22	31.4	463.8	11.2	8.4	31.2	39.0	73.1	52.6
Mean	31.3	367.1a	13.3	10.2	29.4	37.3	70.2	55.0

TABLE 3 continued

Sampling date	Sample dry matter		Percent of dry matter					
	Percent	Grams	Crude protein	Ash	Crude fiber	Acid detergent fiber	Neutral detergent fiber	Estimated dry matter digestibility
					Dallisgrass			
4-18	26.6	250.3	15.4	14.7	25.8	37.7	65.8	56.7
5-2	26.6	303.4	12.4	10.1	30.6	39.6	68.8	55.3
5-16	28.4	243.4	13.9	11.6	28.1	36.8	67.4	56.7
5-30	29.8	319.4	12.5	10.0	30.0	38.3	70.7	56.6
6-13	29.4	274.2	11.3	9.9	30.6	37.9	68.6	56.7
6-27	35.9	356.0	11.0	10.8	30.9	41.0	69.6	56.5
7-11	33.4	254.0	12.2	9.5	29.8	38.2	70.6	55.2
7-25	26.4	284.1	12.8	10.7	29.8	39.0	69.0	53.8
8-8	30.3	448.1	9.6	8.8	30.9	39.4	70.6	53.8
8-22	29.7	370.6	11.0	10.7	29.8	40.6	70.2	52.9
Mean	29.6	310.4b	12.2	10.7	29.6	38.8	69.1	55.4

[1]Means in the same column with different letters are different ($P<.05$).

Sampling date had a significant ($P<.01$) influence on all measured characteristics of the grasses. Data for the three grasses are pooled and shown by date in Table 4. The percentage dry matter in the grasses changed rather quickly as evidenced by the increase from 29.8 on June 13 to 36.7, the highest ($P<.01$) level, on June 27. This was obviously a period of little or no moisture. The amount of dry matter in the samples was an indication of available forage but not forage quality. The amount of dry material was higher after June 13. This may have been the result of less palatable forage accumulating rather than being consumed by the steers.

The ash content was highest ($P<.01$) in the samples cut on April 18. April is usually rather dry in southwest Louisiana with extensive land preparation resulting in high levels of dust in the air. Moisture from the dew might cause the dust to stick to the forage resulting in the high ash content.

Crude protein content of the forages was highest ($P<.01$) when sampled on April 18. There was a varied decline as the season progressed with the lowest ($P<.01$) crude protein occurring in the samples cut on August 8.

Crude fiber and neutral detergent fiber content was lowest ($P<.01$) on April 18 and next lowest ($P<.01$) on May 16. Acid detergent fiber was lowest ($P<.01$) from May 2 through June 13. Acid detergent fiber was highest ($P<.01$) on August 22 and intermediate between June 27 and August 22. Estimated dry matter digestibility was higher ($P<.01$) in samples cut on May 2 and 30 than in samples cut on other dates except May 16 which was only slightly lower. Samples cut on July 25 and August 8 and 22 had the lowest ($P<.01$) estimated dry matter digestibility. Using these four indexes of nutritional value, it appeared that the decrease in forage quality occurred rather suddenly between the middle and end of June.

Utley et al. (1974) reported similar negative and linear declines in in vitro dry matter disappearance for Pensacola bahiagrass and Coastal bermudagrass cut from mid-May to the end of September. Utley et al. (1978) reported Coastal bermudagrass pellets were higher ($P<.01$) in crude protein and acid-detergent lignin and lower ($P<.01$) in cellulose, in vitro dry matter disappearance, and calculated total digestible nutrients than Pensacola bahiagrass pellets.

Lowrey et al. (1969) reported that, except for protein, nutrient digestibility was higher ($P<.05$) for Pensacola bahiagrass than Coastal bermudagrass when both forages were cut at the same age, dehydrated, and fed at similar levels.

Observations of these three grasses during this experiment suggest that there are some important differences between them. Pensacola bahiagrass appeared to withstand wet and dry weather very well and provided grazing

Table 4.—Percentage and quantity of dry matter in samples of all three grasses as cut and composition of dry matter at each date

Sampling date	Sample dry matter		Percent of dry matter					
	Percent	Grams	Crude protein	Ash	Crude fiber	Acid detergent fiber	Neutral detergent fiber	Estimated dry matter digestibility
4-18	30.7cde[1]	258.6de	16.1a	16.6a	24.8f	38.6b	67.1d	55.1de
5-2	29.2de	276.3cde	13.8c	9.9cd	29.0d	36.4cd	68.5bc	57.2a
5-16	28.9e	227.0e	14.7b	12.9b	26.7e	36.4cd	67.6cd	56.9ab
5-30	31.4bc	335.3c	12.8d	9.5de	29.0d	35.7d	69.3b	57.1a
6-13	29.8cde	291.0cde	11.6ef	9.5de	29.7bcd	36.8c	69.2b	55.5cd
6-27	36.8a	430.4ab	11.4ef	9.2e	30.2abc	38.2b	69.4b	56.2bc
7-11	32.7b	304.2cd	12.3ed	9.6de	29.4cd	38.4b	71.1a	54.5e
7-25	29.2de	408.0b	11.8ef	9.4de	30.7a	38.7b	71.1a	53.1fg
8-8	31.0bcd	499.8a	10.0g	8.4f	30.5ab	38.6b	71.6a	53.6f
8-22	31.4bc	481.9a	11.0f	9.3e	30.3abc	39.9a	71.2a	52.8g
Linear effect	*	**	**	**	**	**	**	**
Quadratic effect	**	NS	**	**	**	**	NS	**
Cubic effect	*	NS	NS	**	NS	**	NS	**
Quartic effect	**	NS	NS	**	*	**	NS	NS

[1]Means in the same column with different letters are different ($P<.05$).

*$P<.05$. **$P<.01$. NS $P>.05$.

late in the fall. It produced a good sod that kept out competitive weeds and grasses and provided a good footing for cattle in wet weather. Seed heads appeared very quickly after clipping.

Bahiagrass appeared to require more time to dry than the other grasses when cut for hay. Coastal bermudagrass did not appear to withstand wet or dry conditions very well and did not appear very competitive with other grasses or weeds. It cured quickly for hay. Dallisgrass emerged early in the spring and maintained some growth under most conditions. It appeared to be intermediate in competitiveness to Pensacola bahiagrass and Coastal bermudagrass.

Summary

During a 4-year period, the performance of 1- and 2-year-old Hereford and Hereford-Brahman reciprocal crossbred steers was compared while grazing Coastal bermudagrass, Pensacola bahiagrass, and common dallisgrass. The Hereford-Brahman steers gained faster and had heavier carcasses with more external fat ($P<.05$). Steers grazing dallisgrass gained faster, graded higher, and had more marbling ($P<.05$) than steers grazing Pensacola bahiagrass. Performance of steers grazing Coastal bermudagrass was not significantly different from steers grazing dallisgrass and Pensacola bahiagrass. Year differences were observed in steer performance ($P<.05$).

Forage samples of each grass were taken at 14-day intervals during the last 2 years of this experiment. There were no significant differences in composition of the dry matter or estimated dry matter digestibility among the grasses. There was a higher ($P<.05$) yield of dry matter from the Pensacola bahiagrass and Coastal bermudagrass samples than the dallisgrass samples. Sampling date had an influence ($P<.01$) on all measured characteristics of the grasses.

Literature Cited

A.O.A.C. 1970. Official methods of Analysis (11th Ed.) Association of Official Agricultural Chemists. Washington, D.C.

Chapman, H. D., W. H. Marchant, P. R. Utley, R. E. Hellwig, and W. G. Monson. 1972. Performance of steers on Pensacola bahiagrass, Coastal bermudagrass and Coastcross-1 bermudagrass pastures and pellets. J. Anim. Sci. 34:373.

Duncan, D. B. 1955. Multiple range and multiple F tests. Biometrics 11:1.

Duncan, H. R. 1958. Producing beef on grass from yearling and two-year-old steers with and without supplemental feed. Tenn. Agr. Exp. Sta. Bull. 283.

Feazel, J. T., H. E. Harris, and J. C. Carpenter, Jr. 1972. A comparison of Angus and crossbred steers and heifers. Louisiana Agr. Exp. Sta. Twelfth Livestock Producers Day Rep., p. 168.

Goering, H. K. and P. J. Van Soest. 1970. Forage fiber analysis (apparatus, reagents, procedures and some applications). Agr. Handbook No. 379, USDA.

Hill, G. M., R. A. Harpel, and W. B. Hallmark. 1981. Cow and calf performance on Alicia and dallisgrass pastures. Louisiana Agr. Exp. Sta. Twenty-First Livestock Producers Day Rep., p. 100.

Hill, J. R. and S. G. Woods. 1966. Summer pasture grasses for beef cows in the coastal plains. South Carolina Agr. Exp. Sta. Circ. No. 146.

Hoveland, C. S., C. C. King, E. M. Evans, R. R. Harris, and W. B. Anthony. 1971. Bermudagrass for forage in Alabama. Auburn Univ. (Ala.) Agr. Exp. Sta. Bull. No. 328.

Knox, J. W., P. E. Humes, K. L. Koonce, and D. K. Babcock. 1982. Straightbred and crossbred beef cattle performance in Louisiana. Louisiana Agr. Exp. Sta. Bull. No. 740.

Lowrey, R. S., F. E. Knox, and W. C. McCormick. 1969. Effect of age on nutritive value of Coastal bermuda and bahiagrasses. J. Anim. Sci. 28:142 (Abstr.).

McClaugherty, F. S. and R. C. Carter. 1961. Producing yearling slaughter steers from pasture. Virginia Agr. Exp. Sta. Bull. No. 531.

Nelson, B. D., H. D. Ellzey, C. Montgomery, and E. B. Morgan. 1972. Factors affecting the variability of an in vitro rumen fermentation technique for estimating forage quality. J. Dairy Sci. 55:358.

Nelson, B. D., C. R. Montgomery, P. E. Schilling, and L. Mason. 1976. Effects of fermentation time on in vivo/in vitro relationships. J. Dairy Sci. 59:270.

Oliver, W. M. 1972. Coastal bermudagrass pastures for grazing calves and yearlings in Louisiana. Louisiana Agr. Exp. Sta. Bull. No. 667.

Oliver, W. M. 1974. Gains for purebred and crossbred stocker steers on winter pasture. Louisiana Agr. 18:3.

Reynolds, W. L., T. M. DeRouen, R. S. Temple, and D. C. Meyerhoeffer. 1967. Winter feed and growth of Angus, Brahman and crossbred heifers. J. Anim. Sci. 26:88 (Abstr.).

Schoonover, C. O. 1965. Uniform methods for beef carcass evaluation. Proc. 8th. Reciprocal meat Conf. of the Am. Meat Sci. Assoc. 320.

Suman, R. F. and S. G. Woods. 1966. Beef production from Coastal bermudagrass. South Carolina Agr. Exp. Sta. Bull. No. 524.

Utley, P. R., H. D. Chapman, W. G. Monson, W. H. Marchant, and W. C. McCormick. 1974. Coastcross-1 bermudagrass, Coastal bermudagrass and Pensacola bahiagrass as summer pasture for steers. J. Anim. Sci. 38:490.

Utley, P. R., G. L. Newton, W. G. Monson, R. E. Hellwig, and W. C. McCormick. 1978. Relationships among laboratory analyses of pelleted warm season grasses and animal performance. J. Anim. Sci. 47:276.

Wise, M. B., H. B. Gross, R. S. Soikes, E. H. Evans, Jr., and E. R. Barrick. 1967. Supplementation of Coastal bermudagrass for finishing steers. North Carolina Agr. Exp. Sta. Bull. No. 430.